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AUTHOR McCabe, Robert H.
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ABSTRACT

Florida's Commissioner of Education recently appointed a task force to review current standards for the College-Level Academic Skills Test (CLAST) and the effect of raising the levels of passing scores that are proposed for 1989. There is now a sufficient history of the CLAST to provide an understanding of the program's benefits and liabilities. An analysis of currently available information about the test indicates that: (1) the imposition of the 1989 CLAST standards will drastically reduce the number of students, particularly minorities, fully eligible to proceed to the upper divisions of the State University System, though many of these students would be predicted to have "successful performance through the baccalaureate level"; (2) the number of students taking the CLAST has decreased steadily with each change in its standards; (3) redesigned curricula and increased student expectations initially improved test scores, but this had the concomitant and undesirable outcome of narrowing the undergraduate experience by eliminating opportunities to take courses in the natural sciences, social sciences, and humanities; (4) level test scores of recent years indicate that stronger institutional effort will be needed to achieve limited gain; (5) time limitations of CLAST adversely affect some examinees, particularly minorities; (6) K-12 education reforms have not decreased the number of academically deficient students entering higher education; (7) the current use of CLAST as an upper division criterion ignores educational research which promotes a combination of measures to predict academic success; and (8) CLAST as an admissions tool ignores faculty judgement and student performance. (AYC)

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THE COLLEGE-LEVEL ACADEMIC SKILLS TEST

A REVIEW OF THE 1989 ISSUES

By Robert H. McCabe

President, Miami-Dade Community College

August 1987

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SUMMARY

Florida's Commissioner of Education has recently appointed a task force to review current standards for the College-level Academic Skills Test (CLAST) and the effect of raising the levels of passing scores that are proposed for 1989. The testing program directly impacts the lives of thousands of Floridians and there is now sufficient history to provide an understanding of the program's benefits and liabilities. This paper shows that:

- o imposition of the 1989 CLAST standards will drastically reduce the number of students, particularly minorities, fully eligible to proceed into the SUS upper divisions. Many of these students would be predicted to have "successful performance through the baccalaureate level."
- o the number of students sitting for CLAST have decreased steadily with each change in its standards;
- o redesigned curricula by institutions and increased student expectations initially improved test scores but this has had the concomitant and undesirable outcome of narrowing the undergraduate experience by eliminating opportunities to courses in the natural sciences, social sciences and humanities;
- o level test scores of recent years indicate that stronger effort will be needed by institutions in the future in order to achieve limited gain;
- o time limitations of CLAST adversely affect some examinees, particularly minorities;

- o K-12 education reforms to date have not decreased the numbers of academically deficient students entering higher education;
- o current use of CLAST as an upper division admissions criterion ignores educational research which recognizes a combination of measures to predict academic success; and
- o CLAST, as an admission's tool, ignores faculty judgments and student performance.

A BRIEF CLAST HISTORY

In 1979, the Florida Legislature addressed a series of higher education issues with the purposes of bringing more accountability to bear on public institutions and of raising the academic skills of Florida's college graduates. To the State Board of Education (SBE), the Legislature gave the duty of adopting "minimum standards of college-level communication and computation skills generally associated with successful performance through the baccalaureate level" of college, and within the body of that particular charge, allowed the SBE to modify those standards "from time to time" (see Appendix A). To the Department of Education, as "a part of the system of educational accountability," the Legislature mandated the tasks of maintaining lists, tests and data reflecting the measurement of skills "associated with successful student performance." The task of defining and assembling those skills fell to the state's Articulation Coordinating Committee (Ch. 79-222, LOF).

In the period between the 1979 and 1982 legislatures, two years were spent developing a test to measure college-level academic skills -- CLAST, as it came to be known -- and one year field-testing the instrument. When the 1982 session convened, the growing impatience of legislators -- many of whom assumed a test in place -- prompted more specific accountability measures. They directed the Department of Education, which has been performing maintenance functions per the 1979 law, to "develop or contract for, and submit" for approval tests that accomplished previously given directives (Ch. 82-180, LOF).

To the State Board of Education, the lawmakers mandated adoption of not only "minimum standards" but "minimum and uniform standards" that measured not just successful performance in college, but "progression

through the baccalaureate level" as well (Ch. 82-180, LOF). Scores from the test, now CLAST, were stipulated as an admission requirement for entrance into the State University System's upper divisions, extending "equally and uniformly" to native university students as well as to transfers. Community college district boards of trustees were directed to use "scores on tests for college-level communication and computation skills . . . as a condition for graduation" with an Associate of Arts degree. The only apparent assuagement in the immediacy of the 1982 legislative directives was that between August 1, 1982, and August 1, 1984, test scores were "limited to student counseling and curriculum development" (Ch. 82-180, LOF). Thus, with the beginning of the 1984 academic year, CLAST became an imperative obstacle for students to negotiate in order to remain on the public college campuses of Florida.

The authority to raise, lower or freeze test standards remains vested with the State Board of Education, which may "from time to time, modify" the test(s) or the score levels needed for "progression through the baccalaureate level." In first implementing CLAST in 1982, the Board determined that four subtests consisting of reading, writing, computation and an essay sufficiently addressed the legislative intent. Passing scores on each subtest for the initial year of accountability (1984-85) were increased by plan for the 1986-87 academic year and are scheduled to rise again in 1989-90.

Since the 1982 session, legislators have deemed CLAST useful in more ways than a measure of progression. With the 1983 Legislature, "participation in the college-level communication and computation skills testing program" became an eligibility requirement for state financial aid. As an accountability measure, that requirement also encompasses the tuition

vouchers awarded to Florida students electing to attend private colleges within the state (Ch. 83-291, LOF). As a result of the 1986 legislative session, CLAST finally achieved its own section of the statutes, complete with legislative intent, exemptions, prohibitions, etc. "It is the intent of the Legislature," according to the 1986 law, that the examination has two purposes: "a summative evaluation instrument" and "a source of information for student advisors" (Ch. 86-145, LOF). Further, the new statute made the examination "available to all lower division students" and required that CLAST be administered two times per academic term. (It should be noted here that 15 months after passage of this law, the Department of Education has yet to implement rules making CLAST "available to all lower division students.") As a summative or exit exam, the test has screened out or scared away an increasing number of 'rising juniors'. At each step of change in the CLAST history, the number of students sitting for the exam has steadily decreased. And in an environment where operational funds are enrollment-driven and financial aid for public and private institutions is test dependent, CLAST holds the potential for, among other things, reducing rather than enhancing quality as colleges and universities redesign curriculum and 'teach for the test.'

CLAST AND ITS IMPACT

When viewed as a total program, CLAST has focused greater attention and emphasis on basic academic skills, especially in the state's community colleges. Students graduating from our two-year, public colleges are better prepared than they were five years ago, as a result of both the CLAST initiatives and other academic reforms instituted by the various colleges. Florida's efforts fit well within the national movement to raise academic performance and student expectations. The effort, however, has not been without negative impact.

As previously mentioned, since 1982 the state has experienced a continual decrease in the number of students completing Associate of Arts degrees and native university students proceeding to the upper divisions. Nearly 42,000 students sat for CLAST in 1982, when the test was "limited to student counseling and curriculum development." By 1984, when passing became an imperative, 34,501 wrote the test and of those, only 30,568 were eligible to rise to their junior year. If we apply the scheduled 1989 standards to 1985 test results, only 15,173 students would be eligible to proceed into the State University System's upper divisions.

The broadening experience of the liberal studies lower division curriculum has also been hurt by CLAST emphasis. With the need to increase reading, writing and mathematical skills to meet CLAST requirements, other important subjects have been crowded out of students' programs. Miami-Dade Community College, the state's largest two-year institution, has witnessed a dramatic drop in basic sophomore courses in the last six years. Biology credits have declined by 38 percent and English literature by 64 percent. During the same period, Economics declined by 3,600 credits, a 20 percent drop. Almost paradoxically, the average number of cred-

its earned by M-DCC graduates rose from 74 to 80, the equivalent of two additional courses.

In essence, then, the goal of improving a State-defined set of minimum college-level skills has had the undesirable outcome of narrowing the scope of the undergraduate experience, as CLAST related course work dominates the curriculum, leaving limited opportunity for students to elect other important subjects. The outcome is particularly clear in mathematics, where CLAST competencies are hardly "basic" to functioning effectively in a professional world or, for that matter, for successfully progressing through the baccalaureate level. Yet with the 1989 standards, full competence in algebra will be insufficient to pass the CLAST subtest. This is discussed in some detail later, but the scheduled standards will doubtlessly push more students into more mathematics classes that for most have limited value. Concomitantly, these students will be eliminated from elective opportunities in sophomore level courses in the natural sciences, social sciences and humanities.

The available statewide data on CLAST reflect the great effort that colleges and universities have put into program adjustments in response to the test. There were measurable gains in scores from 1982 through 1984. (See Graphs 1 and 2, Appendix B) Scores for 1985 and 1986, however, show a leveling, and early indications from 1987 reflect a continuation of no appreciable gain. The initial gains may be attributed to a rise in student expectation, a shift in curriculum emphasis, and a winnowing in the number of test-takers.

As an abstraction, CLAST allows for interesting and thoughtful rhetoric about educational values. As a reality, available CLAST data pose for the state's policymakers inescapable questions about the future direc-

tions of higher education and the society in which it exists. Are more increases in student expectations realistic or necessary? How much more restructuring of lower division curricula is necessary to achieve those expectations? Is desirable? How many more students need to fail CLAST in order for it to achieve proper accountability? And perhaps most importantly, at what cut-off point does the test do more harm to that good for the State?

It is clear that the easy part is behind us. Institutions in the future will have to exert stronger effort and expect less gain. Three years of level scores and a rising goal portend an ominous future for students seeking admission to the upper divisions of the State University System (SUS), which draws the majority of its students from the community colleges. For minority students, the future is particularly onerous.

Under the federal guidelines of the Pratt order, Florida has made concerted efforts since the early 1970's to increase the number of minority students participating in higher education through various scholarship, loan or linkage programs. CLAST, however, has contributed to a continual and worrisome decline in the numbers of those students completing the academic curriculum. In 1982 statewide, 3,609 Black students sat for the CLAST examination. By 1985, only 2,072 took the test, and of that number, 1,438 passed. Within the space of three years, there was a 43 percent decline in Black test-takers, and only 69 percent of those were eligible to proceed into the upper division.

For Hispanics, the decline has been equally dramatic. In 1982, Hispanic examinees totaled 3,634; by 1985, that number fell to 2,361 -- a 35 percent decline. Their passage rate was somewhat better at 82 percent. Utilizing 1985 test results, the indication is that imposition of

the 1989 standards would yield a passage rate for Blacks of 18 percent, for Hispanics, 32 percent. (See Chart 2, Appendix B) Only 363 Blacks and 767 Hispanics would be fully eligible to continue with studies in the SUS' upper divisions. While some may argue that this statistical overlay is a "worse case" scenario, data suggest this is the most probable case. It does not even take into account the already existing decline in minorities entering higher education in Florida and nationally. Imposition of the proposed 1989 CLAST standards would only exacerbate an already bleak picture.

CLAST: A TEST QUESTIONED

Discussion and controversy about CLAST has centered mainly on the test's results, rather than the instrument itself or the desired objective(s). If we assume that successful passage of CLAST is a predictor of "successful performance and progression through the baccalaureate level," then we can equally assume that upper division history or literature majors, for example, have an inherent need to discourse unhesitantly on the Pythagorean Theorem ($A^2 + B^2 = C^2$) or to solve probability equations. The philosophical objectives for CLAST were determined by educational policy-makers many years ago; however, within the body of the test, there are important issues concerning content. No where is this more apparent than in the computation subtest.

This subtest (See Appendix C) covers a broad spread of mathematics disciplines, which for the Fall 1987 administration, broke down as follows:

Number of Skills	Skills Area	Items
13	Arithmetic	13
16	Algebra	16
10	Geometry and Measurement	7
8	Logical Reasoning	7
9	Statistics and probability	7
56		50

The spread of disciplines and the esoteric nature of the translation of competencies into questions have put in place a mathematics requirement that is neither basic nor essential for all students to progress through the baccalaureate level. And as mentioned earlier, the requirement is overburdening the students' curricula at the expense of other important subject areas.

The computation test currently consists of 50 test items, most of which deal with arithmetic and algebraic skills. Assuming that these test specifications remain stable, students meeting the 1989 standards will

have to pass as many as 35 items, depending on a specific test administration. It is clear that students with basic arithmetic skills who have completed a college-level algebra course could fail the computation subtest if they lack a background in geometry, logic, and statistics. The choice the informed student will make is to enroll in more math courses that cover more CLAST skills. Why should they risk jeopardizing their success for upward, academic mobility by matriculating in a philosophy, history, government, or literature course?

Another CLAST issue that warrants more consideration is that of time. The test is designed to demonstrate mastery of competencies; therefore, in such a test, sufficient time should be allowed for students to demonstrate those competencies. Survey results from Miami-Dade students indicated that the time allowed does, in fact, limit the ability of some students to demonstrate competencies. CLAST test-takers were asked if more time would have improved their scores. Of those responding, 74 percent agreed that more time would have helped in reading/writing, 61 percent in essay, and 48 percent in computation. Most students who failed one or more subtests believed the lack of time contributed to their low scores. In addition, several studies have found that Black students are particularly unlikely to complete the reading subtest. An M-DCC comparison of performances of students who retook the reading and writing subtests showed a significant advantage to those taking only one subtest in 70 minutes over those retaking two within the same time period, as is current practice. From this it can be concluded that many students are being handicapped by time restrictions. This conclusion is particularly

crucial to earlier points concerning minorities. The retake population of 650 students in the study was comprised of a majority of women, a majority Hispanic, a majority non-native English speakers, and more than one-fourth Black.

THE CLASS OF 1989

One of the stated reasons for incrementally phasing in higher CLAST standards was to allow time for the educational reforms of the early 80's in the public schools to affect positively the caliber of incoming college students. While this notion may be operational for the State University System, it is clearly not the case for two-year colleges. The median age of community college students is 28 years, which means, among other things, that half of the students who will sit for 1989 CLAST graduated from high school before 1979. Historically, most Associate in Arts candidates begin their college educations at least four years prior to receiving their degree. Thus, more than half of the students who came directly to community colleges from high school -- and who will sit for the 1989 exam -- finished their secondary schooling before 1985. These students will have experienced little impact from the educational reforms now being implemented.

Regardless of age and recency of high school graduation, test data for all first-time-in-college M-DCC students reflect no difference in the percentage of academically deficient students from 1980 to 1986. In 1980, 63.5 percent of M-DCC entering freshmen tested as deficient in at least one area; in 1986, 67.3 percent fell into that category. The only improvement that has been evidenced thus far by the high school reforms is the better preparation of superior students, who, based on enrollment patterns, tend to matriculate mainly at four-year institutions. At this point, it appears that the K-12 educational reforms are improving the performances of superior students and not decreasing the number of academically deficient ones.

Recent community college graduates have performed well after transferring, with a mean upper division Grade Point Average (GPA) of 2.8 compared to 2.9 for university natives. This year, the Inter-Institutional Research Council published its study of community college students who took CLAST during 1984-85 and transferred to the SUS by Fall of 1985. The Council found that more than three-quarters of the students (78 percent) who were eligible for "progression through the baccalaureate level" by 1986 standards but ineligible by 1989 standards had maintained an acceptable GPA in the SUS of 2.0 or higher. That figure is close to the success rate (84 percent) for the entire transfer group. Proponents of higher CLAST standards should also consider the fact that 24 percent of those students who were ineligible by 1989 standards had earned GPA's of 3.0 or better. In the group studied, 1,405 students had proven they could succeed in upper division studies, but, by 1989 CLAST standards, they would have not been given the opportunity. According to American judicial standards, defendants are not penalized unless substantial evidence proves them guilty. Had the 1989 CLAST standards been in place for this control group of students, we would have sentenced 1,405 students -- a figure equal to half the University of Florida freshmen class -- to a life of unrealized academic potential, and society would be the worse for it. Unless policymakers are moved to act on the impending standards, the legacy for Class of 1989 will be a dramatic and unacceptable waste of human talent.

A RATIONAL SOLUTION

When the State Board of Education adopted initial CLAST standards no significant performance data were available. Since that time, tens of thousands of Florida college students have taken the various subtests, which by now should have produced a warehouse full of records and data. The emerging data provide an overwhelmingly strong rationale for rethinking the imposition of the 1989 standards, which hold dire consequences for Florida's future. The test has already winnowed thousands of students from the campuses of our public colleges and universities. The 1989 standards will screen the SUS' upper divisions from even more students, many of whom would be capable of compiling excellent academic records.

Hopefully, the task force recently appointed by the Commissioner of Education will recommend against implementing the scheduled standards and seek alternative methods of measuring minimum standards for college-level academic skills. One time-honored and still valid method of measurement is classroom performance, which, when coupled with CLAST scores, could be used as an alternative to total dependence on a test. It is fairly well-documented that some students perform excellently in the classroom, but do poorly on standardized tests, while others exhibit the reverse pattern. (CLAST results also reinforce that fact). The task force may want to consider a combination of the two standards of measurement as this does not penalize the strengths or weaknesses of students.

Professional testing organizations -- ACT, ETS, The College Board, etc.-- unanimously recommend that standardized test scores not be used independent of other criteria in making judgements about students. And rightfully, most collegiate selection processes include tests, transcripts and recommendations to determine a student's ability and motivation.

Further, research has consistently shown that a combination of standardized test scores and classroom performance (GPA) is the best forecaster of future academic success. In keeping with that research, the State University System has adopted a sliding scale approach for freshmen admissions. Lower ACT or SAT scores are required of students with high GPA's in high school, and higher test scores are required of students with lower GPA's. It seems only logical that if such a system is appropriate for freshmen admissions at the State's universities, then it can equally apply to entrance into their upper divisions. For this case, however, the combination would be the lower division GPA and CLAST.

The easiest thing for the State Board of Education to do about the 1989 standards is to simply hold to the current ones. That course of action or inaction, however, ignores CLAST results and educational research. It also excludes the quality judgements that faculty make over a long period of time concerning a student's ability to perform. State Board adoption of a CLAST/GPA criteria would be a statement to students about the importance of their classroom achievements and their motivation to study. The current message is that regardless of the efforts they've made or success they've achieved, everything still hangs with CLAST. The message is as clear as it is wrong.

ACKNOWLEDGEMENT

I am grateful to my Special Assistant Jack Abstein for his contributions to this presentation. Prior to joining Miami-Dade, he was legislative staff in the Florida Senate during the 1980 through 1984 legislatures.

APPENDIX A

Section 229.053(2)(d), Florida Statutes, as created by the 1979 Florida Legislature and amended by the 1982 Legislature.

229.053 General powers of the state board.--

(1) The State Board of Education is the chief policy-making and coordinating body of public education in Florida. It has the general powers to determine, adopt, or prescribe such policies, rules, regulations and standards as are required by law or as it may find necessary for the improvement of the state system of public education. Except as otherwise provide herein, it may, as it shall find appropriate, delegate its general powers to the Commissioner of Education or the directors of the divisions of the department.

(2) The board had the following duties:

(d) To adopt for public universities and community colleges, and from time to time modify, minimum and uniform standards of college-level communication and computation skills generally associated with successful performance and progression through the baccalaureate level; and to approve tests and other assessment procedures which measure student achievement of those skills;

APPENDIX B

TABLES

Chart 1

NUMBER OF STUDENTS
PASSING ALL CLAST SUBTESTS
(1989 ESTIMATED)

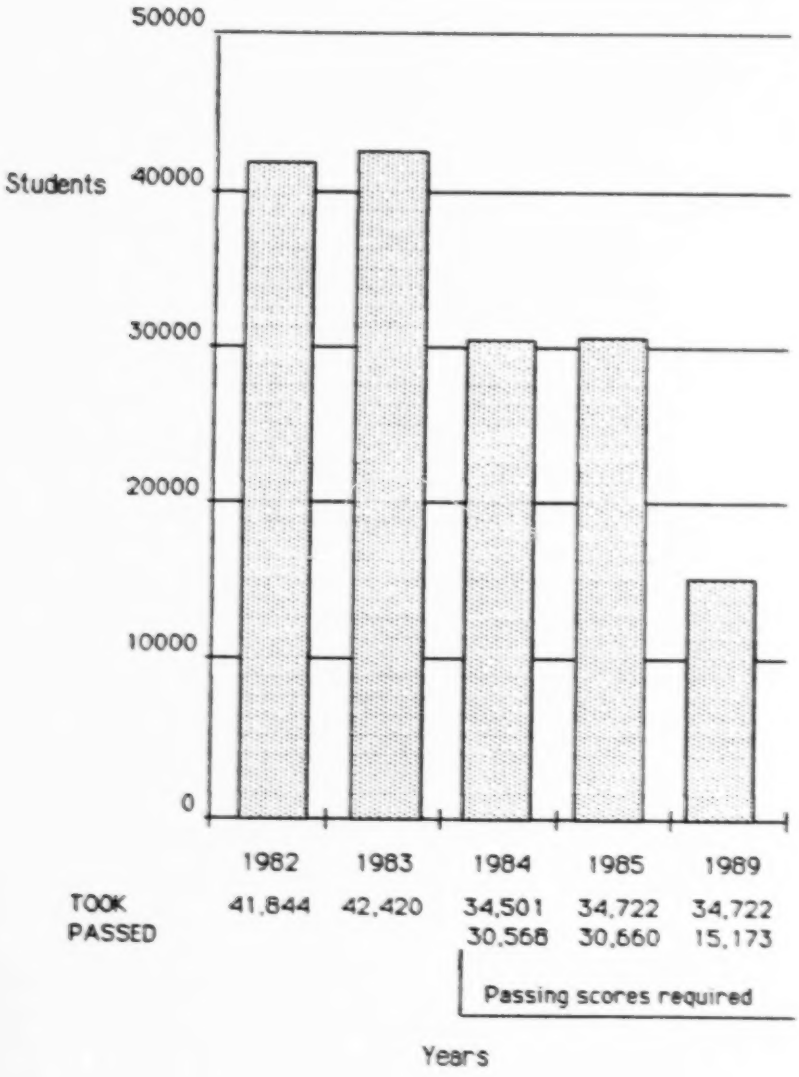
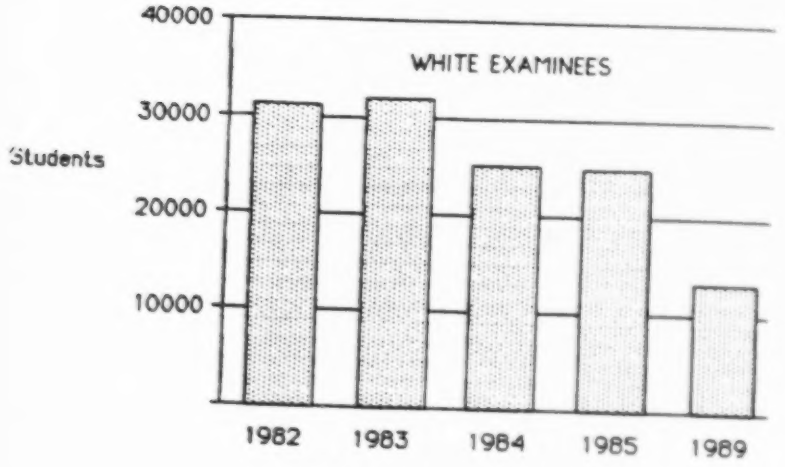


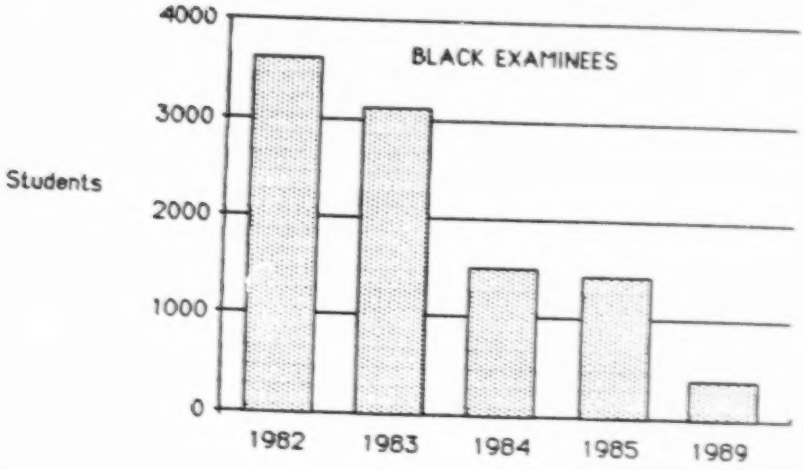
Chart 2

NUMBER OF STUDENTS PASSING ALL FOUR CLAST SUBTESTS BY ETHNIC GROUP (1989 ESTIMATED)



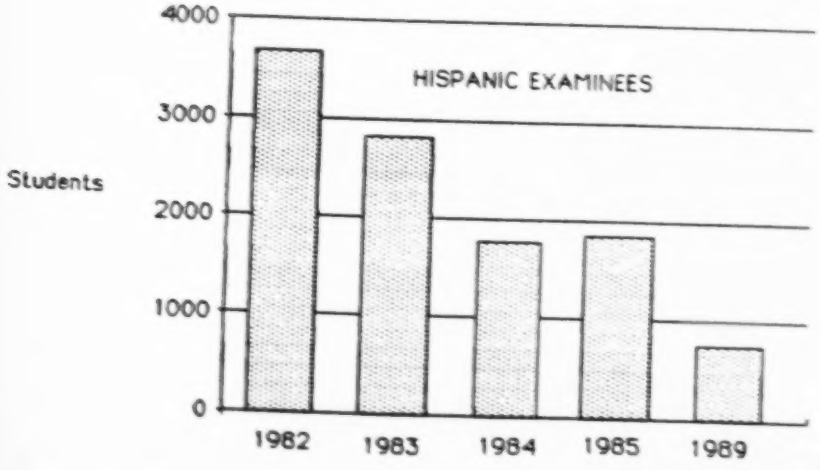
WHITE EXAMINEES

Year	Took	Passed
1982	31,109	
1983	32,253	
1984	26,881	25,187
1985	26,983	25,067
1989	26,983	13,249



BLACK EXAMINEES

Year	Took	Passed
1982	3,609	
1983	3,104	
1984	2,268	1,497
1985	2,072	1,438
1989	2,072	363

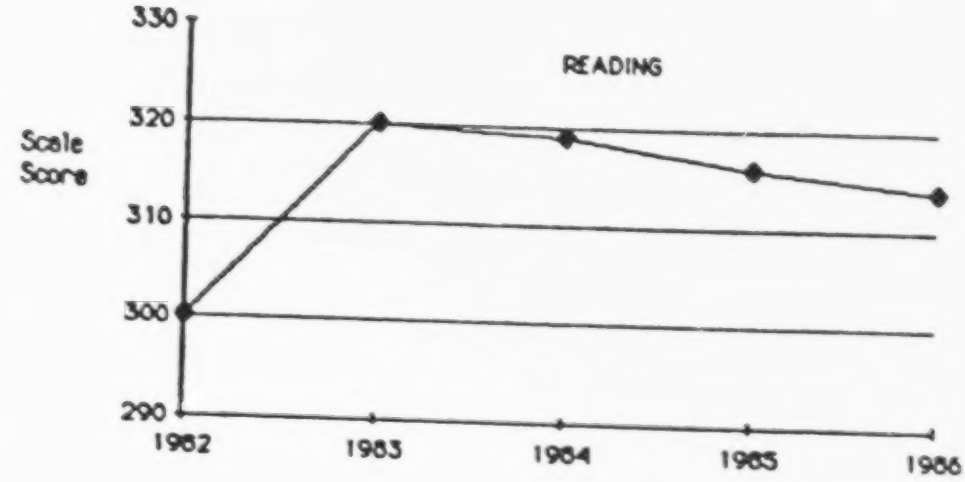


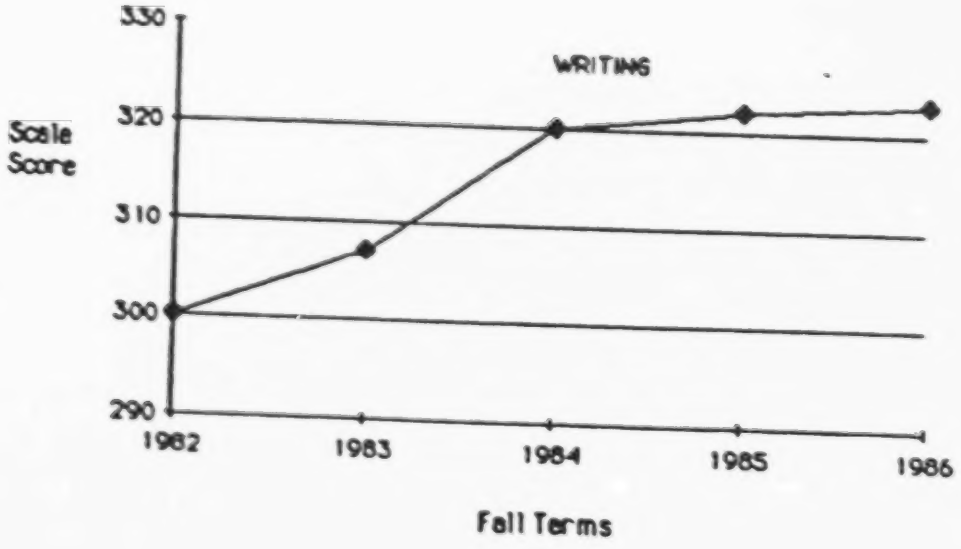
HISPANIC EXAMINEES

Year	Took	Passed
1982	3,634	
1983	2,827	
1984	2,189	1,804
1985	2,361	1,927
1989	2,361	767

GRAPH 1

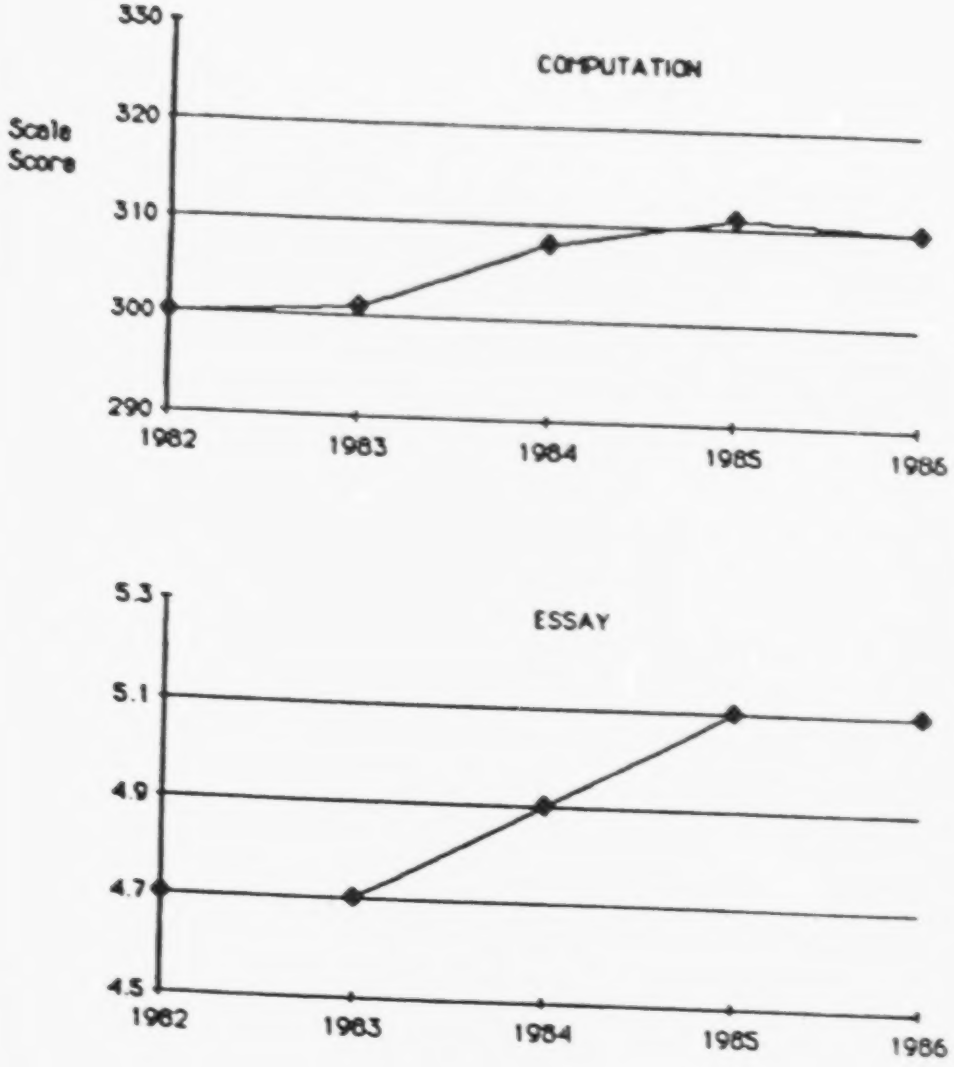
CHANGES IN CLAST STATEWIDE MEAN SCALE SCORES ACROSS FALL TERMS





GRAPH 2

CHANGES IN CLAST STATEWIDE MEAN SCALE SCORES ACROSS FALL TERMS



APPENDIX C

SAMPLE QUESTIONS
COMPUTATION SUBTEST

July 8, 1987

M E M O R A N D U M

TO: John Losak

FROM: Marcia Belcher

SUBJECT: Response to the question "In 1989, will students need higher level math to pass the computation portion of CLAST?"

As part of Dr. McCabe's review of all issues related to the implementation of the CLAST 1989 standards, you asked me to address the issue of what mathematical skills students would need to have in order to achieve these standards. This memo is a review of what I have found.

According to the November, 1985, report entitled "Student Achievement of College-Level Communication and Computation Skills in Florida: 1984-85", students will need to pass 64%-70% of all computation items to meet the 1989 standards. (Note that a range is needed instead of a single number because the difficulty of the test can vary from administration to administration and must be adjusted). As shown below, the Computation test in the Fall of 1987 will consist of 50 items with most dealing with arithmetic and algebra skill areas. Assuming that these test specifications remain stable until 1989, a student would need to pass between 32 and 35 items. Conversely, a student could miss between 15 and 18 items.

Number of Skills	Broad Skills Area	Scored Items
13	Arithmetic	13
16	Algebra	16
10	Geometry and Measurement	7
8	Logical Reasoning	7
9	Statistics, including probability	7
	Total:	50

It is clear that students who had basic arithmetic skills and had finished a college level algebra course and mastered its content could still fail the test if they lacked a background in geometry and measurement, logical reasoning, and statistics. This would particularly be true of students who had not completed the college preparatory track in high school. Students who do not take the college preparatory track in high school are likely to be members of minority groups.

The argument that the computation subtest asks for an unreasonable breadth and depth of knowledge in mathematics can be made another way. The legislators approved a list of computational competencies which sound not unreasonable when read (see, for example, the attached brochure). However, these competencies then had to be operationalized as test items. In the operationalization, elements were added which were not present in the original list, for example, knowledge of the metric system in an arithmetic item.

I have devised a CLAST computation test of 18 items to illustrate this point. The items are sample items distributed by the state to cover the 1987-88 administrations. Anyone who was incorrect on these items would fail the computation portion of the CLAST beginning in 1989. The answer key and the skill being addressed are given following the test. You will note, however, that the test covers all areas, including arithmetic. I should note that while these items were my final choices, you and I had both identified other potential areas and items for inclusion in the test.

The bottom line, of course, is a judgment of whether these are skills that should be required of all college graduates. As I researched this issue and developed this test, I became convinced that the answer should be "no." I certainly could not answer most of these questions. I do not believe I could have even when I was an undergraduate. Yet I deal with numbers and statistics every day and have a doctorate in educational measurement and evaluation. I believe I could have passed this test if I had taken a course on the content. Taking such a course would have meant foregoing a course in my major area of interest, however, since I was attending college on a shoestring.

SAMPLE CLAST COMPUTATION ITEMS

1) Select the place value associated with the underlined digit.

$32\underline{4}01$ (base five)

A. 5^0
B. 5^1
C. 5^2
D. 5^3

2) Directions - Identify the symbol that should be placed in the box to form a true statement.

$3.2\overline{4} \square 3.\overline{24}$

A. =

B. <

C. >

3) Select the property or properties of operation(s) illustrated in this equation:

$3(4 - 2^2) = 3 \times 4 - 3(2^2)$

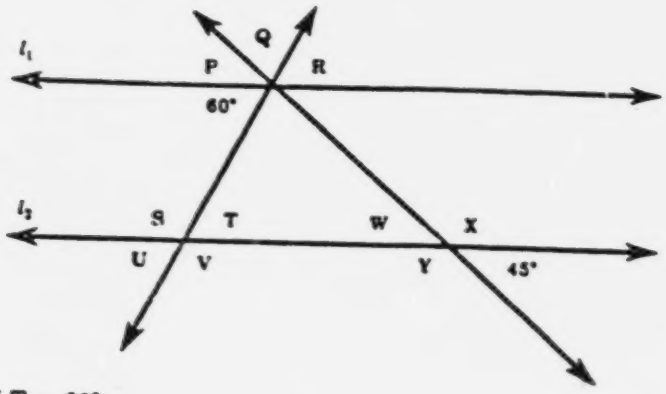
A. distributive property only
B. associative property of multiplication only
C. distributive property and associative property of multiplication
D. distributive property and commutative property of multiplication

4) Find a linear factor of the following expression:

$6x^2 - x - 2$

A. $2x - 1$
B. $3x - 2$
C. $3x + 1$
D. $x - 2$

5) Which of the statements below the figure is true for the figure shown, given that l_1 and l_2 are parallel lines?



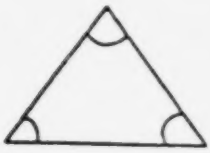
A. Since $m\angle T = 60°$
$m\angle S = 100°$

B. Since $m\angle T = 60°$
$m\angle Q = 75°$

C. $m\angle V = m\angle R$

D. None of the above statements is true.

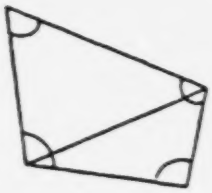
6) Study the given information. For each figure, S represents the sum of the measures of the interior angles.



3 sides →

1 triangle

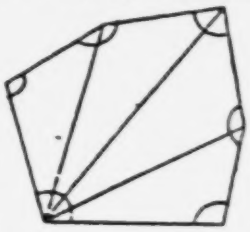
S = 180°



4 sides →

2 triangles

S = 360°



6 sides →

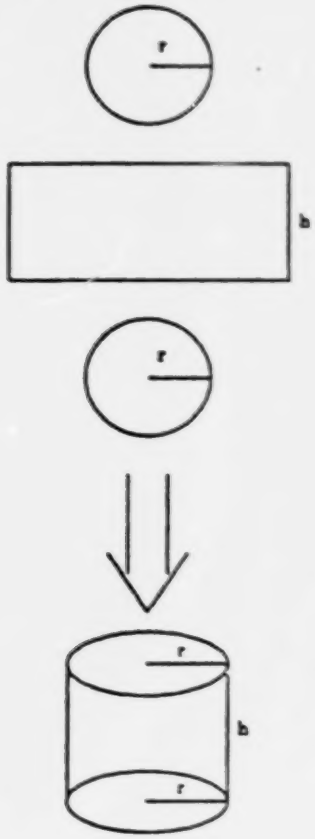
4 triangles

S = 720°

Calculate S, the sum of the measures of the interior angles of an eight-sided convex polygon.

A. 1000°
B. 1080°
C. 1260°
D. 1440°

7) Study the figure showing the circles which form the top and bottom of a right circular cylinder and the rectangle which bends around to form the cylinder's "sides". Then select the formula for calculating the total surface area (SA) of a right circular cylinder.



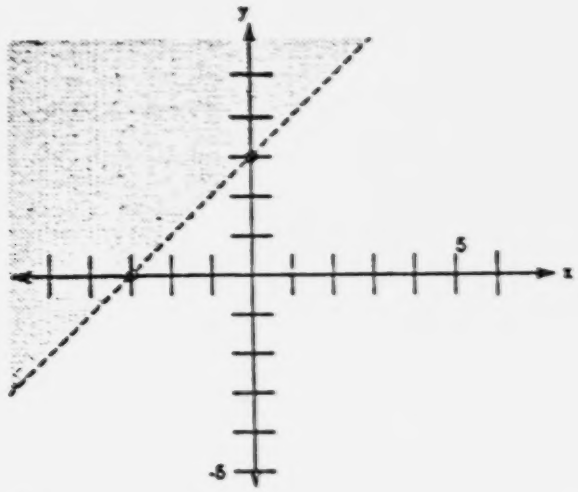
A. $SA = \pi r^2 h$

B. $SA = h(2\pi r) + \pi r^2$

C. $SA = 2\pi r^2 + h(2\pi r)$

D. $SA = 2(2\pi r) + h(2\pi r)$

8) Which option gives the condition(s) that corresponds to the shaded region of the plane shown below?



A. $x < 3$ and $y > 3$

B. $y = -x$

C. $x < 3$; $y > 3$, and $y > x$

D. $y > x + 3$

9) **Directions - Using the following table, solve the problem which is given.**

Standard deviations above mean	Proportion of area between mean and indicated standard deviation above mean
.00	.000
.25	.099
.50	.192
.75	.273
1.00	.341
1.25	.394
1.50	.433
1.75	.460
2.00	.477
2.25	.488
2.50	.494
2.75	.497
3.00	.499

One hundred fifth graders took an aptitude test which has a mean of 50 and a standard deviation of 10. If their scores are normally distributed, approximately what proportion of the children scored between 45 and 55?

A. .19
B. .34
C. .38
D. .62

10) **Select the property used to justify the following statement:**

If $-3x > 5$, then $x < \frac{5}{-3}$

A. If $a > b$, then $a + c > b + c$.
B. If $a > b$ and $b > c$, then $a > c$.
C. If $ac > bc$ and $c > 0$, then $a > b$.
D. If $ac < bc$ and $c < 0$, then $a > b$.

11) Find the real roots of this equation: $x^3 - x - 4 = 0$

A $\frac{-1-\sqrt{5}}{2}$ and $\frac{-1+\sqrt{5}}{2}$

B. $\frac{1-\sqrt{5}}{2}$ and $\frac{1+\sqrt{5}}{2}$

C. $\frac{-1-\sqrt{17}}{2}$ and $\frac{-1+\sqrt{17}}{2}$

D. $\frac{1-\sqrt{17}}{2}$ and $\frac{1+\sqrt{17}}{2}$

12) $\sqrt{2} + \sqrt{8} =$

A. $\sqrt{10}$

B. $3\sqrt{2}$

C. 4

D. 68

13) Two representatives are chosen at random from a group of 100 students, consisting of 50 girls and 50 boys. What is the probability that the two representatives selected are either both boys or both girls?

A. $2 \times \frac{50}{100} \times \frac{49}{99}$

B. $\frac{50}{100} \times \frac{49}{99}$

C. $\frac{2}{50} + \frac{2}{50}$

D. $\frac{2}{50} \times \frac{2}{50}$

14) Read each of the following valid arguments. Then select the symbolic form of the reasoning pattern illustrated by both arguments.

If Harry is to get the discount, then he must pay the bill before May 1. Harry does not pay the bill before May 1. Thus, Harry does not get the discount.

Mary works hard in the course if she likes her instructor. She does not work hard in the course. Therefore, Mary does not like her instructor.

A. $p \rightarrow q$
$\sim q$
$\therefore \sim q$

B. $p \rightarrow q$
$\sim q$
$\therefore \sim p$

C. $p \rightarrow q$
$\sim p$
$\therefore \sim q$

D. $p \rightarrow q$
q
$\therefore p$

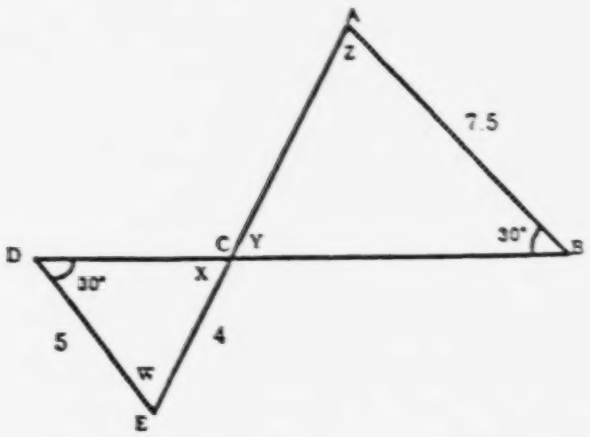
15) Study the examples illustrating ways of combining objects two at a time.

3 objects	4 objects	5 objects
{m, n, p}	{x, y, z, w}	{c, d, e, f, g}
(m, n)	(x, y)	(c, d)
(m, p)	(x, z)	(c, e)
(n, p)	(x, w)	(c, f)
	(y, z)	(c, g)
	(y, w)	(d, e)
	(z, w)	(d, f)
		(d, g)
		(e, f)
		(e, g)
		(f, g)

How many two member combinations can be formed from a set containing 6 objects?

A. 12
B. 15
C. 18
D. 21

16) Which of the statements is true for the pictured triangles?



A. $m\angle Z \neq m\angle W$

B. $m\angle X = 30°$

C. $AC = 6$

D. $\frac{CE}{CA} = \frac{CB}{CD}$

17) A radio station is going to construct a 12 foot tower for a new antenna on top of a tall building. The tower will be supported by three cables, each attached to the top of the tower and to points on the roof of the building which are 5 feet from the base of the tower. What is the total length of these three cables?

A. 13 feet
B. 42 feet
C. 39 feet
D. 52 feet

18) What is the volume in centiliters of a 2.65 liter bottle?

A. 2.65 cl
B. 26.5 cl
C. 265 cl
D. 2650 cl

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